

Complete Set of Claims Serial No. 717,042
As of July 7, 1988

103. (Thrice Amended) In a system of a plurality of vehicles, an apparatus on-board each of said vehicles for acquisitioning data indicative of vehicle operation and for relaying said data to a remote control center where the data is processed to create control signals that are delivered back to said apparatus for instructing a vehicle operator regarding vehicle movement, said apparatus comprising:

(1) means mounted to said vehicle for indicating a loading of material into a dump body of said vehicle by a loader;

(2) means mounted to said vehicle for indicating a dumping of a load carried by said body;

(3) means mounted to said vehicle for indicating a direction of movement by said vehicle;

a first processor means on-board said vehicle for acquiring data generated from means (1), (2) and (3) and processing said data for downloading to a remote control center; and

(4) means for sending said processed data to said remote control center and for receiving control signals therefrom.

104. (Once Amended) An apparatus as set forth in claim 103 wherein said means (1) comprises a bi-state switch positioned in a recess of a bed of said dump body so as to detect a presence of material carried in said dump body.

105. (Twice Amended) An apparatus as set forth in claim 103 wherein said means (1) comprises a pressure sensor assembly mounted to a frame of said vehicle for transferring from said dump body to said frame at least a predetermined portion of a total weight of said dump body in a substantially uniform manner along an interface between said frame and said dump body and said assembly is responsive to said predetermined portion of said total weight to provide pressure data representative of said total weight of said dump body.

2. (Fourth Amended) An apparatus as set forth in claim 103 wherein said first processor means includes (1) memory means for storing data indicative of a predetermined maximum weight capacity for said dump body, (2) detection means responsive to incremental increases in a total weight of said dump body for determining an approximate weight of material added by a bucket of a loader, (3) comparison means responsive to said memory, first processor and detection means for determining if said total weight minus said predetermined maximum weight for said dump body is a fraction of said approximate weight of material in said bucket, and (4) display means responsive to said comparison means for indicating a remaining weight capacity of said truck body.

3. (Twice Amended) An apparatus as set forth in claim 2 wherein said detection means includes:

means for detecting a monotonic increase in the total weight of said dump body; and

means for storing said increase.

4. (Thrice Amended) An apparatus as set forth in claim 105 wherein said first processor means includes means for isolating pressure data representing pressure spikes and means for recording the occurrence of a pressure spike, and means responsive to said recording means for delivering data to said display means indicative of a condition of a road over which said vehicle travels.

5. (Thrice Amended) An apparatus as set forth in claim 2 wherein said display means includes a display of said remaining weight capacity of said dump body as a fraction of said approximate weight of material in said bucket.

6. (Twice Amended) An apparatus as set forth in claim 5 wherein said display means comprises a series of light indicators representative of an approximate capacity of said bucket, said series of light indicators being relatively positioned such that each light indicator visually represents a fractional portion of said approximate weight of material in said bucket.

7. (Once Amended) An apparatus as set forth in claim 105 wherein said pressure sensor assembly includes a cushioning interface between said dump body and said frame.

8. (Thrice Amended) An apparatus as set forth in claim 105 wherein said dump body is pivotally mounted to said frame by way of a hinge assembly such that said pressure sensor assembly supports said total weight of said dump body in a lowered position on said frame along an interface between said frame and dump body with none of said

total weight of said dump body transferred to said frame via said hinge assembly.

9. (Thrice Amended) An apparatus as set forth in claim 8 wherein said hinge assembly has body and frame portions and also has means for decoupling said body and frame portions when said dump body is moved to said lowered position such that said total weight of said dump body is communicated to said frame through said pressure sensor assembly.

10. (Thrice Amended) An apparatus as set forth in claim 105 wherein said pressure sensor assembly comprises at least one length of resilient tubing positioned on a beam of said frame wherein said resilient tubing provides an interface between said dump body and said frame for communicating said at least predetermined portion of said total weight of said dump body to said frame.

11. (Fourth Amended) An apparatus as set forth in claim 105 including:

first transceiver means mounted to said vehicle;

said first processor means operatively coupled to said first transceiver means and said pressure sensor assembly for receiving said data from said pressure sensor assembly, processing said data and transmitting said processed data by way of said first transceiver where said processed data includes an indication of a hauling status for said vehicle; and

said remote control center including a second processor means having a second transceiver means for communicating with said first transceiver means, said second

processor means receiving said processed data from said first processor means, said processed data identifying said vehicle and said hauling status of said vehicle derived from data from means (1), (2) and (3).

12. (Fourth Amended) An apparatus as set forth in claim 11 wherein said vehicle may be loaded by any one of a plurality of loaders;

said second processor means includes 1) first means for calculating in response to said processed data an average load time for each of said plurality of loaders, 2) second means responsive to said processed data and said first means for calculating a current load delay time for each of said plurality of said loaders, 3) third means responsive to said second means for identifying a one of said plurality of said loaders having a minimum load delay 4), fourth means responsive to said third means for forming data for transmission by said second transceiver means, said data for transmission identifying a particular one of said plurality of vehicles and said one of said plurality of loaders with said minimum load delay; and

said first processor means including fifth means responsive to said data received from said fourth means via said first transceiver for displaying to said vehicle operator of said particular one of said plurality of vehicles an identifier of said one of loaders.

13. (Once Amended) An apparatus as set forth in claim 11 wherein said pressure sensor assembly includes tubings which forms said interface between each of said body and frame of said vehicle.

14. (Thrice Amended) An apparatus as set forth in claim 11 wherein said second processor means includes memory means for archiving said processed data from said vehicle.

15. (Thrice Amended) An apparatus as set forth in claim 11 wherein said first processor means generates said processed data for transmission in response to said pressure data from said pressure sensor assembly and data generated by means (2) and (3) which are indicative of whether said vehicle is dumping its load, beginning loading of a new load or in transit between load and dump sites.

16. (Thrice Amended) An apparatus as set forth in claim 15 wherein said means (2) is a dump sensor and means (3) is a gear sensor and said first processor means generates said processed data for transmission in response to data from a plurality of sensors on-board said vehicle including said gear and dump sensors.

17. (Thrice Amended) An apparatus as set forth in claim 11 wherein said second processor means includes memory means for archiving said processed data in response to vehicle identification and vehicle type data included in said processed data, thereby forming a data base.

18. (Thrice Amended) An apparatus as set forth in claim 17 wherein said data base formed by said processed data archived in said memory means is used by said second processor means to generate said control data for controlling the movement of said vehicle.

19. (Thrice Amended) An apparatus as set forth in claim 105 wherein said first processor means includes:

means for storing said pressure data acquired from said pressure sensor assembly;

means for comparing selected pressure data in said storing means with other pressure data in said storing means to determine if said selected pressure data are pressure spike;

means responsive to said comparing means for counting the pressure spikes; and

means responsive to said counting means for providing an indication of the condition of a road over which said vehicle travels.

20. (Fourth Amended) An apparatus as set forth in claim 105 including:

said first processor means providing an indication of a load or dump condition of said vehicle in response to said pressure data from said pressure sensor assembly;

distance means for measuring the distance traveled by said vehicle and providing said distance to said first processor means so as to be incorporated into said processed data;

storage means responsive to said processed data for storing a distance traveled by said vehicle between said indications of load and dump conditions and for storing a total weight of a load hauled by said vehicle between said indications; and

means responsive to said storage means for multiplying said distance traveled by said total weight hauled in order to provide a tons-miles record as part of said storage means.

21. (Thrice Amended) An apparatus as set forth in claim 20 including means for dividing said tons-miles record by a time interval between successive indications of said load and dump conditions, thereby providing an indication of wear experienced by said vehicle.

22. (Thrice Amended) An apparatus according to claim 105 including:

memory means operatively coupled to said first processor means;

means coupled to said first processor means for entering an identifier of said vehicle operator and for associating a portion of said memory means with said identifier;

said first processor means responsive to said pressure data for 1) providing said processed data which is indicative of vehicle performance and 2) routing said processed data indicative of vehicle performance to locations within said portion of said memory means associated with said identifier;

detecting means responsive to said entering means for detecting changes in said identifier; and

display means responsive to said detecting means for displaying said processed data indicative of vehicle performance in said portion of memory means when a change of said identifier has occurred.

23. (Thrice Amended) An apparatus according to claim 11 including:

said second processor means including memory means for storing a predetermined maximum load capacity for said dump body; and

said first processor means including means for determining a weight of said dump body from said pressure data of said pressure sensor assembly and incorporating said weight as part of said processed data;

said second processor means responsive to said processed data for 1) comparing said weight with said predetermined maximum load capacity, and 2) generating an output signal identifying said vehicle if said weight is greater than said predetermined maximum load capacity.

24. (Thrice Amended) An apparatus as set forth in claim 23 including means responsive to said first processor means for displaying said weight of said dump body in response to said first processor means.

25. (Thrice Amended) An apparatus as set forth in claim 23 including means in said second processor means for accumulating a total number of times said output signal indicating an overload of the vehicle is generated.

26. (Thrice Amended) An apparatus as set forth in claim 105 where said vehicle includes front and back axles and said apparatus includes means for measuring loads carried by said front and rear axles of said vehicle wherein said dump body is pivotally mounted to said frame so as to pivot between raised and lowered positions, said means comprising:

(5) means for measuring a force of said dump body on said frame and providing data indicative of said force;

said first processor means responsive to said data from said means (5) and said pressure sensor assembly for determining a distribution of said weight of said dump body over said front and rear axles of said vehicle; and

display means responsive to said first processor means for displaying portions of said weight of said dump body carried by said front and rear axles.

27. (Thrice Amended) An apparatus as set forth in claim 26 wherein hydraulic cylinders connected between said frame and dump body move said dump body between said raised and lowered positions, said means (5) sensing pressures of hydraulic fluids in said hydraulic cylinders.

28. (Thrice Amended) An apparatus as set forth in claim 26 wherein said first processor means includes means for locating a center of gravity of said dump body.

29. (Twice Amended) An apparatus as set forth in claim 26 wherein said first processor means includes memory means storing predetermined tare weights for said front and rear axles and said first processor means including summing means for adding said portion of said weight on each of said front and rear axles to the tare weight of each of said front and rear axles in order to find a gross weight for each of said front and rear axles.

30. (Thrice Amended) An apparatus as set forth in claim 105, including means for pivoting said dump body between raised and lowered positions on said dump body,

said pressure sensor assembly including a plurality of sensor elements and providing an interface between said frame and dump body when said dump body is in a lowered position,

said plurality of sensor elements provides an indication of the total weight of said dump body and an indication of fore-and-aft weight distribution as well as side-to-side weight distribution of the load carried by the dump body; and

said first processor means having means responsive to said plurality of sensor elements of said pressure sensor assembly for detecting an imbalance of said weight carried by said dump body and signaling said vehicle operator in response thereto.

31. (Thrice Amended) An apparatus as set forth in claim 105 wherein said body is pivotally mounted to said frame for movement between lowered and raised positions and said apparatus includes a distance sensor for providing data to said first processor means indicative of truck movement, said first processor means including means responsive to said distance sensor and to said pressure sensor assembly for providing an output signal when said vehicle moves without said dump body in said lowered position.

32. (Thrice Amended) An apparatus as set forth in claim 105 wherein said dump body is pivotable between raised and lowered positions and wherein said first processor means includes 1) memory means for storing a tare weight of said dump body, 2) means responsive to the lowering of said dump body onto said pressure sensor assembly for comparing said total weight of said dump body with said tare weight in said memory means, and 3) means for indicating said dump body is

not fully empty when said total weight of said dump body is greater than said tare weight of said dump body plus a predetermined constant.

33. (Thrice Amended) An apparatus for processing data derived from a weight of a load carried by a body of a truck, said apparatus comprising:

a truck frame including a hinge assembly for pivotally supporting said truck body between raised and lowered positions;

a pressure sensor assembly mounted to said frame for supporting an entire weight of said body in its lowered position and providing pressure data representative of said entire weight of said truck body;

a processor means for receiving said pressure data and detecting a change in said entire weight of said truck body and formulating data indicative of truck condition in response to said pressure data and its change;

a distance sensor for providing distance data to said processor means indicative of truck movement; and

said processor means including first means responsive to said pressure data for detecting said truck body raised off said pressure sensor assembly and second means responsive to said first means and said distance data for providing an output signal when said truck moves with said body raised off said pressure sensor assembly.

34. (Twice Amended) An apparatus for processing data derived from a weight of a load carried by a body of a truck, said apparatus comprising:

a truck frame including a hinge assembly for pivotally supporting said truck body between raised and lowered positions;

a pressure sensor assembly mounted to said frame for supporting a weight of said body in its lowered position and providing pressure data representative of said weight of said truck body;

a processor means for receiving said pressure data and detecting a change in said weight of said truck body and formulating data indicative of such condition in response to said pressure data and its change; and

said processor means including (1) memory means for storing a predetermined tare weight of said truck body, (2) means responsive to a lowering of said truck body onto said pressure sensor assembly after a load carried by said body has been dumped for comparing said weight of said truck body with said tare weight in said memory, and (3) means for indicating said body is not fully empty when said weight of said body is greater than said tare weight of said body plus a predetermined constant.

35. (Thrice Amended) An apparatus for determining a remaining weight capacity of a body carried on a truck frame which is loaded with a material by a bucket of a loader and for indicating when a weight of said material in a full average bucket is more than said remaining weight capacity of said body, said apparatus comprising in combination:

a truck frame including a hinge assembly;

a truck body pivotally mounted to said truck frame at said hinge assembly, said truck body being pivotally movable on said frame between lowered and raised positions;

a pressure sensor assembly mounted to said frame for supporting a weight of said body in its lowered position and providing pressure data representative of a weight of said truck body;

a processor means for receiving said pressure data and determining said weight of said truck body, said processor means including;

(1) memory means for storing data indicative of a predetermined maximum weight capacity for said truck body, (2) detection means responsive to incremental increases in said weight of said truck body for approximating a weight of said material added by said bucket, (3) comparison means responsive to said weight, said predetermined maximum weight capacity and said weight of said material added by said bucket for determining said remaining weight capacity of said truck body, and (4) display means responsive to said comparison means for indicating said remaining weight capacity of said truck body.

36. (Twice Amended) An apparatus as set forth in claim 35 wherein said detection means includes;

first means for detecting an increase in said weight of said truck body; and

second means for storing said increase.

37. (Twice Amended) An apparatus as set forth in claim 35 wherein said processor means includes means for isolating pressure data representing pressure spikes and means for recording an occurrence of a pressure spike, and means responsive to said recording means for delivering data to said display means indicative of a road condition.

38. (Once Amended) An apparatus as set forth in claim 35 wherein said display means includes a display of a remaining weight capacity of said truck body as a percentage of said weight of said material carried by said bucket.

39. (Once Amended) An apparatus as set forth in claim 38 wherein said display means comprises a series of light indicators representative of a volume capacity of said bucket, said light indicators being relatively positioned such that each light represents a fractional portion of said volume capacity of said bucket.

40. An apparatus as set forth in claim 35 wherein said pressure sensor assembly is also a cushioning interface between said truck body and said truck frame.

41. (Once Amended) An apparatus as set forth in claim 35 wherein said pressure sensor assembly includes a support means mounted on said truck frame, said support means directly supporting said truck body on said truck frame when said truck body is in a lowered position, said support means supporting said truck body in its lowered position in such a manner as to support an entire amount of said weight of said body along an interface between said truck frame and body with none of said weight of said body transferred to said truck frame via said hinge assembly.

42. (Once Amended) An apparatus as set forth in claim 35 wherein said hinge assembly has body and frame portions and also has means for decoupling said body and frame portions when said truck body is moved to said lowered position such that an entire amount of said weight of said truck body is communicated to said truck frame through said pressure sensor assembly.

43. (Once Amended) An apparatus as set forth in claim 35 wherein said pressure sensor assembly comprises at least one length of resilient tubing positioned on a beam of said truck frame wherein said resilient tubing provides an interface between said truck body and said truck frame for communicating an entire amount of said weight of said body to said frame when said body is in said lowered position.

44. (Twice Amended) A system for minimizing a hauling time for each of a plurality of trucks between load and dump sites, said system comprising:

a plurality of on-board weighing devices each mounted on one of said plurality of trucks for providing signals indicative of a truck's operation;

a plurality of processor means each mounted to one of said plurality of trucks and each processor means responsive to a one of said plurality of on-board weighing devices for receiving said signals from said one of said plurality of on-board weighing devices and processing said signals to provide data indicative of a hauling status;

a plurality of first transceiver means each mounted to one of said plurality of trucks for receiving said data indicative of a hauling status from said one of said plurality of processor means and transmitting said hauling status data in association with additional data that identifies said one of said plurality of trucks; and

a remote processing center including second transceiver means for receiving said hauling status and truck identifying data from said one of said plurality of first transceiver means, said remote processing center generating a historical data base, containing said data indicative of a hauling status and indexed by said identifying data.

45. A system as set forth in claim 44 wherein said on-board weighing device includes a pressure sensor assembly mounted on the frame of the truck and supporting the body of the truck uniformly along an interface between the truck body and frame.

46. (Twice Amended) A system as set forth in claim 44 wherein a plurality of loaders are provided at said load sites for loading said plurality of trucks; and

said remote processing center includes 1) first means for calculating in response to at least said data base an average load time for each of said plurality of loaders, 2) second means responsive to at least said data base and said first means for calculating a current load delay time for each of said plurality of loaders, 3) third means responsive to said second means for identifying one of said plurality of loaders with a minimum load delay time, 4) fourth means responsive to said third means for forming control data for transmission by said second transceiver means, said control data identifying a particular one of said plurality of trucks and a particular one of said plurality of loaders with said minimum load delay time; and

each of said plurality of processor means mounted to said plurality of trucks includes fifth means responsive to said control data received by said first transceiver for displaying for said particular one of said plurality of loaders identified by said control data.

47. A system as set forth in claim 44 wherein said pressure sensor assembly includes tubings which forms the interface between each of said body and frame of said trucks.

48. (Once Amended) A system as set forth in claim 44 wherein said data base comprises a memory means responsive to said remote processing center for archiving said hauling status and identifying data transmitted from said plurality of trucks.

49. (Twice Amended) A system as set forth in claim 44 wherein said processor means generates hauling status data for transmission in response to said signals from said pressure sensor assembly which are indicative of whether a particular one of said plurality of trucks is dumping its load, beginning a loading or in transit between load and dump sites.

50. (Once Amended) A system as set forth in claim 44 wherein said remote processing center includes memory means for archiving said hauling status and identifying data from each of said plurality of processors in groups such that said data base is firstly identifiable with individual ones of said plurality of trucks and secondly identifiable with types of trucks comprising said plurality of trucks.

51. (Twice Amended) A system as set forth in claim 50 wherein said remote processing center is responsive to the said data base formed by said hauling status and identifying data archived in said memory means to generate control data for controlling a movement of said plurality of trucks by causing said second transceiver to transmit said control data to said plurality of first transceivers.

52. (Once Amended) A method for detecting and recording a degree of road roughness for a truck having a body supported on a frame, said method comprising the steps of:

periodically calculating a value of a force derived from a weight of said truck body on said truck frame;

storing said value so as to accumulate a plurality of stored values;

periodically comparing a selected one of said plurality of stored values with other of said plurality of stored values to determine if said one of said plurality of stored values is a spike wherein said spike is a stored value that is greater than said other of said plurality of stored values by a predetermined amount;

accumulating said spikes and providing a total count of said spikes; and

deriving from said total count of said spikes an indication of the degree of road roughness and displaying said indication.

53. (Once Amended) A method as set forth in claim 52 wherein said force derived from said weight of said truck body on said truck frame is calculated with said truck body fully lowered onto said truck frame.

54. (Once Amended) A method as set forth in claim 52 wherein said force derived from said weight of said truck body on said truck frame is provided by a pressure sensor interfaced between the truck body and frame to communicate a predetermined portion of said weight of said truck body to said truck frame.

55. (Thrice Amended) A system for measuring a degree of tire use by a vehicle which hauls material in a dump body pivotally mounted to a frame of said vehicle, said apparatus comprising;

distance means for measuring a distance traveled by said vehicle and providing distance data;

an on-board weighing device responsive to a weight of a load of said material hauled by said vehicle for providing 1) weight data and 2) data indicative of a beginning and an ending of a haul cycle;

storage means responsive to said distance means and said on-board weighing device for accumulating said distance and weight data; and

processor means responsive to said weight and distance data for 1) time marking at least a portion of said distance and weight data so as to identify an elapsed time of said haul cycle, 2) determining a total distance and a weight of said material for said haul cycle, 3) multiplying said total distance and said weight of said material for said haul cycle to provide a sum, 4) dividing said sum by said elapsed time, and 5) displaying a value resulting from said multiplying means.

56. An apparatus as set forth in claim 55 wherein said on-board weighing device includes a pressure sensor assembly mounted on said frame of said vehicle which fully supports said weight of said load when said body is pivoted into a lowered position.

57. An apparatus as set forth in claim 56 wherein said body is pivotally mounted to said frame by way of a

hinge assembly such that said body is fully supported by said pressure sensor assembly when said truck body is in said lowered position.

58. (Thrice Amended) An apparatus for use in connection with an off-road, heavy-duty truck wherein said apparatus records vital statistics of said truck in connection with an identifier entered into said apparatus by a truck operator, said apparatus comprising:

a processor means including memory means;

means coupled to said processor means for entering said identifier and associating a first portion of said memory means with said identifier;

measuring means for providing signals indicative of a hauling status of said truck to said processor means;

said processor means responsive to said measuring means and said entering and associating means for 1) receiving said signals, 2) providing data indicative of truck performance in response to said signals and 3) routing said data to locations within said first portion of said memory means;

detecting means responsive to a change of said identifier to cause said entering and associating means to associate a second portion of said memory means with a new identifier resulting from said change of said identifier; and

said processor means responding to said associating of said second portion of said memory means with said new identifier by routing said data to locations within said second portion of said memory means.

59. (Once Amended) An apparatus as set forth in claim 58 wherein said truck has a body pivotably mounted on a truck frame, said measuring means including:

a pressure sensor assembly supporting an entire weight of said body on said truck frame when said body is in a fully lowered position and said pressure sensor assembly providing pressure data representative of said weight of said truck body; and

said memory means including data indicative of a predetermined maximum weight for said truck body.

60. (Thrice Amended) A system for identifying an overload condition in an off-road, heavy-duty truck having a body mounted to a truck frame by a hinge assembly for movement between lowered and raised positions, said apparatus comprising, in combination:

a sensor assembly mounted on said truck frame and supporting a predetermined portion of a weight of said truck body on said truck frame when said truck body is in said lowered position, said sensor assembly responding to said weight of said body to provide a signal indicative of said weight of said body;

a means for transferring said signal to a remote, off-board processor means;

said remote off-board processor means responsive to said signal and including memory means for storing a predetermined maximum weight capacity for said truck body; and

said remote off-board processor means responsive to said signal from said sensor assembly indicative of said weight for comparing said weight with said predetermined maximum weight capacity, and for generating an output signal if said weight indicated by said signal is greater than said predetermined maximum weight capacity.

61. (Twice Amended) A system as set forth in claim 60 including means for displaying said weight of said truck body.

62. (Thrice Amended) A system as set forth in claim 60 including means in said remote off-board processor means for accumulating a total number of times said output signal is generated.

63. (Twice Amended) An apparatus for measuring and manipulating various hauling and loading parameters for an off-road, heavy duty truck having a body, a frame and front and rear axles, said apparatus comprising:

a first weighing device on said truck for measuring a first force of said truck body on said truck frame and providing data representative of said first force;

a second weighing device on said truck for measuring a second force of said truck body on said truck frame and providing data indicative of said second force;

a processor means responsive to said first and second weighing devices for determining a fraction of a total weight of said truck body over said front axle and a fraction of said total weight of said truck body over said rear axle of said truck; and

display means responsive to said processor means for displaying said fractions of said total weight supported by said front and rear axles.

64. An apparatus as set forth in claim 63 wherein said truck frame includes a hinge assembly and said truck

body is pivotally mounted to said truck frame at said hinge assembly such that said truck body is pivotable between raised and lowered positions, said first weighing device supporting the entire weight of said truck body when said truck body is in its lowered position.

65. (Twice Amended) An apparatus as set forth in claim 64 wherein hydraulic cylinders connected between said truck frame and body move said truck body between said raised and lowered positions, said second weighing device sensing a pressure of hydraulic fluid filling said hydraulic cylinder.

Claims 66-68 have been cancelled.

69. An apparatus for measuring and manipulating various hauling and loading parameters for an off-road, heavy duty truck having a body, a frame and front and rear axles, said apparatus comprising in combination:

hinge assemblies pivotally joining said truck frame and body;

a sensor assembly mounted on said truck frame and including a plurality of sensor elements, said sensor assembly supporting a predetermined portion of a weight of said truck body when said truck body is in a lowered position on said truck frame;

said sensor assembly providing an interface between said truck frame and body when said body is in said lowered position such that said plurality of sensor elements provides an indication of said weight of said truck body and an indication of fore-and-aft and side-to-side distribution of said weight of said truck body; and

processor means responsive to said sensor assembly for detecting an imbalance of said weight carried by said truck body and signalling a truck operator in response thereto.

Claims 70-72 have been cancelled.

73. A stationary platform scale for placement on an approximately level ground surface, said scale comprising, in combination:

a first planar plate;

a plurality of flexible tubing laid on said first planar plate with each tubing having first and second ends;

a second planar plate positioned to rest atop said plurality of flexible tubing, said second planar plate extending to fully cover said plurality of flexible tubing;

a plurality of pressure sensors each secured to one of said first or second ends of each of said plurality of flexible tubing for providing pressure data indicative of a weight present on said second planar plate;

said second planar plate having a lower surface for direct contact with each of said plurality of flexible tubing wherein said lower surface includes a calibration plate to ensure a known surface area of contact between said plurality of flexible tubing and said second planar plate; and

means for gathering all the data from said plurality of pressure sensors and determining a weight present on said second planar plate.

74. A stationary platform scale as set forth in claim 73 including stabilization means coupling said first and second planar plates to retard movement parallel to the planes of said plates while simultaneously allowing the plates to move relative to one another in a direction normal to the planes of said plates.

75. (Thrice Amended) In a system for controlling a routing of a fleet of vehicles composed of distinct groups to a plurality of possible locations, a method for monitoring and commanding vehicle movement comprising the steps of:

sensing a weight and a change in said weight of a load carried by each vehicle and formulating data representative of said weight and said change in weight;

transferring said data to a central location;

cataloging at said central location said data from each vehicle;

selecting one of said distinct groups of vehicles;

combining said data from said one of said distinct groups of vehicles to provide collective data indicative of group performance; and

analyzing said cataloged and collective data to provide commands for transfer to selected vehicles in said fleet of vehicles.

76. (Thrice Amended) In a system for controlling a routing of a fleet of load-carrying vehicles composed of distinct groups to a plurality of possible locations, an apparatus for monitoring and commanding vehicle movement comprising, in combination:

first means on-board each of said vehicles in said fleet of vehicles for sensing a change in a load carried by said vehicle and forming data representative of said change;

second means on-board each of said vehicles for transmitting said data;

a central computer for receiving said data from each of said vehicles in said fleet of vehicles and 1) cataloging said data to provide averages for each of said vehicles, 2) analyzing said averages from each of said vehicles and 3) forming control data in response to said analysis that includes identification data identifying at least one vehicle in said fleet of vehicles; and

transmitting means coupled to said central computer for transmitting said control data to a vehicle identified by said identification data.

77. (Once Amended) In a system as set forth in claim 76 including repeater transmitters strategically located along routes of said fleet of vehicles and each of said repeater transmitters receiving said data from vehicles in its vicinity and retransmitting said data to said central computer such that said retransmitted data identifies said each repeater transmitter, thereby providing an approximate location of each vehicle in said fleet of vehicles.

78. (Once Amended) In a system as set forth in claim 76 wherein said control data includes data designating sites for loading and dumping loads carried by said fleet of load-carrying vehicles and each vehicle in said fleet includes a display means responsive to said control data for displaying said designated sites to a vehicle operator.

79. (Thrice Amended) In a system as set forth in claim 76 wherein each vehicle in said fleet of vehicles is loaded with material by a loader and said data from said first on-board means provides an indication of the operation of said loader;

said central computer including means responsive to said data for providing a quantitative indication of an efficiency of said loader.

80. (Thrice Amended) In a system as set forth in claim 76 wherein each vehicle in said fleet of vehicles includes a pivotal body mounted on a frame for movement between raised and lowered positions and said first on-board means includes a pressure sensor assembly mounted to said frame for supporting a weight of said body in said lowered position.

81. (Thrice Amended) In a system as set forth in claim 76 wherein said first on-board means includes means for detecting an increase in said load carried by said vehicle.

82. (Twice Amended) In a system as set forth in claim 80 wherein an interface is formed where said pivotal body meets said frame, said pressure sensor assembly is mounted on said frame such that said pressure sensor assembly extends continuously along said interface when said body is moved to said lowered position.

83. (Thrice Amended) In a system for controlling a routing of a fleet of trucks composed of distinct groups to

a plurality of possible locations and including a central computer for receiving data from said trucks and issuing commands to said trucks, said trucks having a dump body pivotally mounted to a frame, an apparatus on-board each of said trucks comprising, in combination:

a pressure sensor assembly mounted to each truck in said fleet of trucks for providing pressure data indicative of a weight of said dump body;

a processor means on-board each of said trucks for receiving said pressure data and detecting a change in a weight of said body, and providing output data indicative of a truck operating condition; and

transmitter means on-board each of said trucks for receiving said output data from said processor means and transmitting said output data to said central computer for further processing.

84. In the system set forth in claim 83, said central computer including means for receiving said output data and formulating a data base for each truck and each group of trucks, said central computer also including means responsive to said data base for providing control data to a second transmitter means operatively coupled to said central computer.

85. In the system set forth in claim 84, a receiver means on-board each of said trucks for receiving said control data and delivering it to said processor means.

86. (Once Amended) In the system set forth in claim 85, said processor means including means responsive to said control data to provide display data to an on-board display means for use by a truck operator.

87. (Twice Amended) An apparatus for measuring a weight of a load carried by a body of a truck, said apparatus comprising, in combination:

a truck body and a truck frame;

means for coupling said body to said frame to inhibit side-to-side or fore-to-aft movement of said body with respect to said frame but allowing limited non-rotating vertical movement; and

a pressure sensor assembly supporting a predetermined portion of a weight of said body along an interface between said body and frame such that a weight of said body is transferred to said frame uniformly along said interface.

88. An apparatus as set forth in claim 87 wherein said pressure sensor assembly includes a signal output indicative of pressure and said apparatus includes a processor means for receiving said signal output.

89. (Thrice Amended) An apparatus as set forth in claim 88 wherein said processor means includes means for detecting a change in said weight of said truck body and formulating data indicative of said truck condition in response to said pressure data.

Claims 90-94 have been cancelled.

95. (Thrice Amended) A system for automatically measuring a weight of a vehicle body and automatically transferring a measurement of said weight to a remote stationary site, said system comprising, in combination:

a vehicle frame for supporting said body;

a pressure sensor assembly mounted on said vehicle frame and positioned along an interface between said vehicle body and frame for supporting a predetermined portion of said weight of said vehicle body such that said assembly distributes said predetermined portion of said weight of said vehicle body in a substantially uniform manner along said interface, said assembly providing at least one output signal indicative of a pressure at said interface between said body and frame;

means remote from said vehicle for receiving said at least one output signal and formulating an indication of said weight of said body; and

coupling means joining said pressure sensor assembly and said remote means for automatically transferring said at least one output signal from said assembly to said remote site.

96. (Twice Amended) A system according to claim 95 wherein said at least one output signal from said pressure sensor assembly is fluid under pressure and said remote means is a pressure responsive device for providing a visual indication indicative of said weight of said body and said coupling means is a conduit for communicating said fluid under pressure from said assembly to said pressure responsive device remote from said vehicle.

97. (Once Amended) A system according to claim 95 wherein said at least one output signal from said pressure sensor assembly is an electrical signal and said remote means is a circuit responsive to said electrical signal when received via said coupling means.

98. A system according to claim 97 wherein said pressure sensor assembly comprises liquid-filled tubing.

99. (Thrice Amended) In a system utilizing pressurized tubing, an apparatus for terminating an end of said tubing and for insuring the termination is leak-proof under high pressures, said apparatus comprising, in combination:

an end clamp located at said end of said tubing and comprising first, second and third portions;

said third portion of said end clamp located inside said tubing while said first and second portions fit over an outside surface of said tubing and oppose one another so as to sandwich said tubing and third portion between said first and second portions;

means for joining said first, second and third portions of said clamp with said tubing so as to totally seal the end of said tubing; and

a collar surrounding said tubing at an area proximate said end of said tubing but rearward of said end clamp, said collar having a central bore for receiving said tubing and restraining said tubing from changing its cross-sectional shape in an area of said tubing under and adjacent to said collar.

100. (Thrice Amended) In a system for monitoring hauling parameters of a vehicle with a dump body that pivots between raised and lowered pivotal positions, an on-board apparatus comprising, in combination:

a sensor mounted on said body and responsive to the pivoting of said body for providing an output signal

indicative of said raised or lowered positions of said body, said sensor being totally encapsulated in a housing in order to prevent ambient conditions from reducing the responsiveness of said sensor;

a processor for receiving said output signal from said sensor and responding to said output signals in a predetermined manner; and

means communicating said output signal from said sensor to said processor wherein said means includes an output port in said housing which maintains said sensor in isolation from an ambient environment.

101. The on-board apparatus as set forth in claim 100 wherein said sensor is a mercury switch.

102. (Thrice Amended) In a system for controlling a routing of each vehicle in a fleet of material-hauling vehicles to one of a plurality of possible load or dump locations, an apparatus for monitoring and commanding vehicle movement comprising, in combination:

means on-board each of said vehicles for providing an indication of a beginning of a loading of material into said vehicle and a dumping of said material from said vehicle and, in response to said indication, forming data indicative of said loading or dumping;

first transceiver means on-board each of said vehicles for transmitting said data;

a central computer having a second transceiver means for receiving said data from each of said vehicles and having a processor and a memory for formulating from said data a data base from which control data is derived, said central computer including means for transmitting said

control data to said vehicles, said control data including data identifying a particular vehicle and a particular one of said plurality of possible load or dump locations; and

said first transceiver means receiving said control data and said on-board sensing means responding to said control data to visually indicate said particular one of said plurality of possible load or dump destinations on an on-board display means.

106. (Once Amended) An apparatus on-board a vehicle, being one of a plurality of similar vehicles, for acquisitioning data indicative of vehicle operation and for accumulating said data, said apparatus comprising:

first means mounted to said vehicle for providing data indicative of a loading of material into a dump body of said vehicle and a dumping of said material by said dump body;

second means mounted to said vehicle for providing data indicative of a movement of said vehicle;

a first processor means on-board said vehicle for acquiring said data from said first and second means and organizing said data to provide information regarding performance of said vehicle; and

a storage means for receiving said data from said first processor means and storing said data as organized by said first processor means.